4] Stel de hoeveelheid S in het lichaam als M, dan

$$\frac{dM}{dt} = P - \lambda M \overset{!}{=} 0$$

evenwicht

dus $\lambda = P/M = \frac{700\,g/d \cdot 140 \cdot 10^{-3}\,g/kg}{7700\,g \cdot 500 \cdot 10^{-3}\,g/kg} = 2{,}55 \cdot 10^{-2}\,d^{-1}$

$$T_{1/2} = \frac{\ln 2}{\lambda} = 27{,}2\,d.$$

b] $\lambda^{eff} = \lambda^{fys} + \lambda^{biol} = \frac{\ln 2}{8{,}4\,d} + \frac{\ln 2}{21{,}2\,d} = 3{,}34 \cdot 10^{-2}\,d^{-1}$

$$U_S = f_1 \frac{A}{\lambda^{eff}} = 1 \cdot \frac{1\,Bq}{3{,}34 \cdot 10^{-2}\,d^{-1}} = 2{,}59\,10^{6}\,Bqs$$

c] $SEE = E/m = \frac{0{,}04\,g\,MeV}{7700\,g} = 6{,}36 \cdot 10^{-6}\,MeV/g.$

d] $e_{ing}(50) = U_S \cdot SEE = 2{,}59\,10^{6}\,Bqs \cdot 6{,}36 \cdot 10^{-6}\,MeV/g$

$= 16{,}5$ MeV/g

$= 16{,}5 \cdot 10^{6} \cdot 1{,}6 \cdot 10^{-19}$ J/10^{-3} kg

$= 2{,}64 \cdot 10^{-9}$ J/kg

$= 2{,}64 \cdot 10^{-9}$ Sv per Bq

Eig 4 → $e_{lung}(50) = 77 \cdot 10^{-10}$ Sv/Bq voor volwassene.

dus: $\frac{2{,}64 \cdot 10^{-9}}{77 \cdot 10^{-10}} = 3{,}4$

45) a) 97% $T_{1/2} = 10\,d$ $\lambda_1 = 6{,}9 \cdot 10^{-2}\,d^{-1}$

3% $T_{1/2} = 40\,d$ $\lambda_2 = 1{,}7 \cdot 10^{-2}\,d^{-1}$

$\lambda^{eff} = 0{,}97\,\lambda_1 + 0{,}03\,\lambda_2 = 6{,}7 \cdot 10^{-2}\,d^{-1}$

$U_S = F_1 \frac{A}{\lambda} = 1 \cdot \frac{1\,Bq}{6{,}7 \cdot 10^{-2}\,d^{-1}} = 1{,}3 \cdot 10^{6}\,Bq\,s$

$F_1 = 1$

b) $SEE = E/m = \frac{5{,}7 \cdot 10^{-3}\,MeV}{20000\,g} = 2{,}1 \cdot 10^{-8}\,MeV/g$

c) $e_{inh}(50) = U_S \cdot SEE = 1{,}3 \cdot 10^{6}\,Bq\,s \cdot 2{,}1 \cdot 10^{-8}\,MeV/g$

$= 1{,}7 \cdot 10^{-11}\,Sv$ per Bq.

46) a) $U_s = F_1 \cdot \frac{A}{\lambda^{eff}}$ $\quad T_{1/2}^{Fus} = 12{,}35\,j$

97% $T_{1/2} = 3{,}5\,d$

3% $T_{1/2} = 15\,d$

$\lambda_1 = \frac{\ln 2}{12{,}35 \cdot 365\,d} + \frac{\ln 2}{3{,}5\,d} = 2{,}0 \cdot 10^{-1}\,d^{-1}$

$\lambda_2 = \quad " \quad + \frac{\ln 2}{15\,d} = 4{,}6 \cdot 10^{-2}\,d^{-1}$

$\lambda^{eff} = 0{,}97\,\lambda_1 + 0{,}03\,\lambda_2 = 0{,}19\,d^{-1}$

$U_s = 1\,\frac{Bq}{0{,}19\,d^{-1}} = 4{,}4 \cdot 10^5\,Bq\,s$

b) $SEE = E/m = \frac{0{,}0057\,MeV}{g_{Boog}} = 5{,}0 \cdot 10^{-7}\,MeV/g$

c) $e_{ing(50)} = U_s \cdot SEE = 4{,}4 \cdot 10^5\,Bq\,s \cdot 5{,}0 \cdot 10^{-7}\,MeV/g$

$= 4{,}1 \cdot 10^{-11}\,Sv$ per Bq.

Volwassene: $e_{ing(50)} = 1{,}0 \cdot 10^{-11}\,Sv/Bq \rightarrow$ factor 2,3

47) Ga uit van evenwicht, dus productie = lozing

dan: $30\ MBq/2000\ m^3 = 1{,}5 \cdot 10^4\ Bq/m^3$

ademtempo: $1{,}2\ m^3/h$

dus: $1{,}5 \cdot 10^4\ Bq/m^3 \cdot 1{,}2\ m^3/h = 1{,}8 \cdot 10^4\ Bq/h$

werktijd: $2000\ h/j$

dus: $1{,}8 \cdot 10^4\ Bq/h \cdot 2000\ h/j = 3{,}6 \cdot 10^7\ Bq/j = 36\ MBq/j$

effectieve inname: $150\% \cdot 1{,}5 \cdot 36 = 54\ MBq/j$

$E(50) = A \cdot e(50) = 54\ MBq/j \cdot 1{,}8 \cdot 10^{-11}\ Sv/Bq$

$= 0{,}97\ mSv/j$

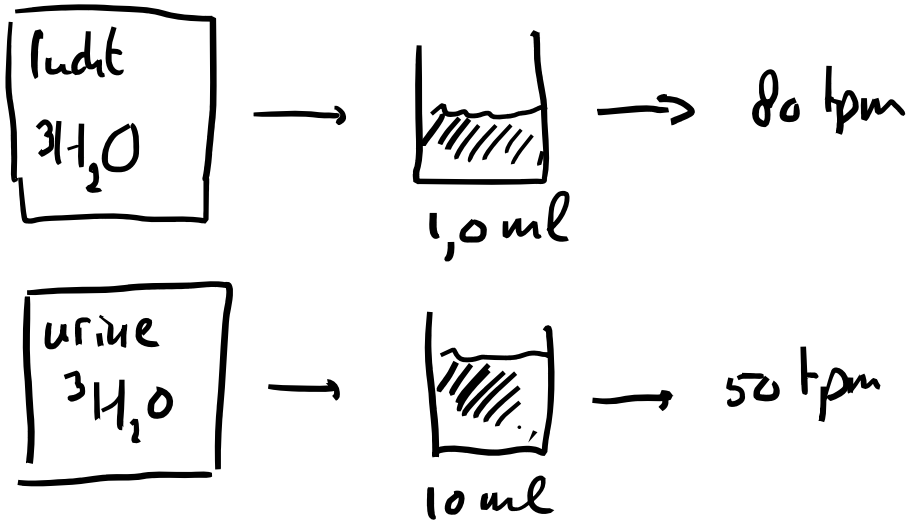
b) 8 uur per werkdag

opname per werkdag: $\frac{8}{2000} \cdot 54\ MBq = 0{,}22\ MBq$.

waterverdeling:

urine	1,4 l/d	concentratie:
zweet	0,65 l/d	$\frac{0{,}22\ MBq}{3\ l/d} = 73\ Bq/ml$
overig	0,95 l/d	
	3,00 l/d	

4g]



nuleffect: 20 tpm
rendement 25%

a] $\dot{N} = f_{det} A \Rightarrow \frac{80-20}{60} = A \cdot 0{,}25 \Rightarrow A = 4$ Bq in 1,0 ml

b] 1 m³ lucht bevat 0,8.22 g = 17,6 g water $\hat{=}$ 17,6 ml water

dus 1 m³ lucht bevat 17,6 ml · 4 Bq/ml = 70,4 Bq.

c] Jaardosis: 2000 h/j · 1,2 m³/h · 70,4 Bq/m³ = $1{,}7 \cdot 10^5$ Bq/j

$E(50) = A \cdot e(50) = 1{,}7 \cdot 10^5$ Bq/j · $1{,}8\ 10^{-11}$ Sv/Bq = 3,0 mSv/j

Effectieve inname 150%, dus 4,5 mSv/j.

a) $\dot{N} = A \cdot \int dt = \frac{50-20}{60} = A \cdot 0{,}25 \Rightarrow A = 2\,Bq$ in $10\,ml$

$= 0{,}2\,Bq/ml.$

e) $0{,}2\,Bq/ml \quad 42\,l = 8{,}4 \cdot 10^3\,Bq.$

f) $4{,}4 \cdot 10^{-10}\,Sv/J \cdot 8{,}4 \cdot 10^3\,Bq \cdot 1\,J = 3{,}7\,\mu Sv.$